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Scene of banquet, one of the highlights of ALPA's Fourth Annual Safety Forum.

The ALPA Air Safety Forum

Two Critically-Important Problems—Air Traffic Control And Airport Development—Shared Spotlight At Largest Forum Yet

By Helmut Lorsch

Asst. Editor, THE AIR LINE PILOT

Two of aviation's most current and critical problems—air traffic control and airports—occupied the spotlight at the Fourth Air Line Pilots Association Air Safety Forum, held at the Hotel Shoreland, Chicago, March 6, 7 and 8.

The Forum was probably the most important held so far, as well as the largest with nearly 175 pilot, industry, air line, military, and government representatives attending and participating in the three-day session.

The discussions and papers explored all sides of the problem from as many standpoints as there were interests represented, and an exploration of progress being made was found in first-hand reports of what is presently being done and what is in the planning stage for the future.

The consensus of all the technical, operational and regulatory know-how represented at the Forum, if it can be summed up in one sentence, is this: "We're all in the same vanishing air space together, facing the same problems whose solution lies in a gigantic cooperative effort to overcome it."

Highlights

Highlighted were these factors: (1) a more adequate air traffic control system is needed; (2) airport development and improvement is necessary to enable such a system to properly

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function; (3) a single control agency is necessary to reconcile all air-space user requirements in a common system.

The course of the Safety Forum was keynoted by ALPA President Sayen in his opening remarks.

Both air traffic control and airports are inadequate, he said.

"Our air traffic control system is completely inadequate to handle just IFR traffic with the necessary efficiency and safety," he pointed out.

At the same time, he emphasized, the see-and-be-seen principle is in a state of obsolence and therefore a system already inadequate to handle IFR traffic faces the problem of having to take over VFR traffic as well.

He pointed out that there were critical and necessary requirements to be considered for all users of airspace—air line, military, corporate pilot and private pilot.

"All of these conflicting interests must be reconciled," Sayen said, "in an air traffic control system that can keep up with the pace. The situation has developed to the point where there has been some multiple control of air space. But there is a growing realization that that can't be countenanced and there must be one single agency in control of all airspace."

Airport Crisis

He called the airport problem "critical," economically and safety-wise: "Our airports today are just becoming adequate for the DC-3 really, and yet, we're getting ready to fly jets out of them . . . (despite the fact) that according to a recent CAA statement this country has no single civil airport, or, any single runway on a civil airport, which could accommodate or handle a fully loaded intercontinental jet transport."

ALPA's evaluation of immediate needs in airport improvements, according to Sayen, are: (1) approach lights, an area in which "we still haven't achieved standardization even in theory let alone installation"; (2) runway lighting, a field in which "we have set standards, but not reached standardization"; (3) runway marking.

In summary of the total problem, as viewed by the pilot, Sayen said: "Airport congestion is a terrible handicap today. A new concept and approach is needed—that of considering the airport as part of the airways system and putting the two problems together."

As in the past, the Fourth Air Safety Forum followed a panel-discussion format.

ALPA's SAFETY ORGANIZATION PANEL: R. Adickes, C. F. Eck, T. G. Linnert, L. H. Mouden, (Forum Master of Ceremonies); E. J. Bechtold, B. Frees.

ATC PANEL: D. S. Little, S. P. Saint, M. Karant, J. D. Smith, J. H. Hilton, Col. L. S. Lightner.

AIRPORT PANEL: J. F. Martin, H. O. Fisher, A. M. Johnston, E. A. Cutrell, R. Aldrich, Vice Adm. C. E. Rosendahl.

COCKPIT INSTRUMENTATION STANDARDIZATION PANEL: J. J. Kelley, D. S. Little, W. L. Hitt.

Five Panels

Five panels made up the major portion of the program. They were: (1) ALPA Air Safety Organization, a closed meeting solely restricted to ALPA members. Here air safety problems of immediate concern to the membership were openly discussed. Panel members were T. G. Linnert and C. F. Eck, ALPA engineers, and Capts. E. J. Bechtold, Robert Adickes and Burke Frees, ALPA Central Safety Chairmen. (2) Evaluation of Air Traffic Control Requirements—Present and Future. (3) Cockpit Instrumentation Standardization. (4) Airport Safety. (5) Passenger Evacuation and Survival.

ATC Panel

ALPA New York Regional Air Safety Chairman, J. D. Smith, head of the ATC panel, saw the lack of an adequate air traffic control system as one of the most serious blocks to further expansion of aviation. Said he: "The present airport problem is of such magnitude, that it is felt, regardless of the eventual solution, we will not be able to move more traffic in the next 15 years than we presently know how to handle. Presently, we know how to safely move at least 80 aircraft an hour through an airport during instrument weather. Airport construction required to permit this volume is tremendous and must be expeditiously and intelligently planned for."

"The long-range solution should have the basic requirement of permitting an expeditious and orderly transition," Smith pointed out. "We have learned from sad experience that we cannot go directly from one system to another overnight."

Outlines Needs

This requires, Smith asserted: (1) Airports capable of handling more and more traffic; (2) Better traffic control of planes on the ground; (3) Better traffic control of planes in the air.

To fulfill these requirements, Smith urged:

- Better visual aids, such as the center-line approach lights at Idlewild and Newark airports, along with better runway marking lights.
- More accurate altimeters that meet more rigid standards than presently.
- Airborne navigational equipment capable of clearly indicating to the crew the exact position of an aircraft at all times.
- Immediate work, a realistic airport expansion and development plan to keep pace with aviation progress and aircraft technocracy.
- An adequate proximity warning indicator.
- Better control of aircraft traffic, probably on an area basis.

Others on the Air Traffic Control panel were: Sam Saint, ATC Consultant to American Airlines, who spoke on "Specific Requirements for An Immediately Usable Automatic Air Traffic Control System"; David S. Little, Operations Supervisor, American Airlines: "Area Vs. Route Air Traffic Control"; J. H. Hilton, CAA, Chief, Systems Requirements: "ATC Requirements, Present and Future"; Col. L. S. Lightner, Chief, ATC Branch: "Analysis of USAF ATC Requirements"; and Max Karant, Vice President, Aircraft Owners and Pilots Association: "ATC — Private Pilots' Viewpoints."

Some highlights of their statements:

- **D. S. Little:** "We must provide ourselves immediately with that traffic control system, which will simultaneously, safely and efficiently handle both tactical and logistical aviation. We must face the complexity and high costs of providing a new ATC system —one designed to control all airspace . . . One of our prime tools of such accomplishment very obviously must be Radar—radar in just about all of its many forms . . . Why cannot CAA and USAF cooperate . . . ? Perhaps the Air Defense and Air Traffic problems are one and the same. It is believed a full analyzation of ADC and ATC operational requirements will at least develop much common ground. If so, why not one control unit per geographic area, which covers both?"
- **Col. Lightner:** "We have been working with CAA on a plan for controlling all airspace above 24,000 feet. The need for positive separation of all aircraft at high altitudes is urgent. But, the plan on which we are working is only an interim step toward positive separation of all aircraft at the higher altitudes. Briefly, the interim plan would be as follows: (1) Develop high-altitude charts, using selected navigational aids which would provide coverage on a grid basis. (2) High altitude sectors would be established in conjunction with ARTC's and direct pilot to controller communications provided. (3) The existing airway structure would terminate at 24,000 feet. Minimum altitude separation would be 1000 feet between 25,000 and 29,000 feet inclusive. Above 29,000 feet, 2000 feet separation would be used. A 20-mile route width has been proposed for lateral separation. Time separation would remain as it is today. (4) Initially, use of VFR or 1000 feet on top would be continued. But in time this type of operation could be considerably reduced. The plan is not a complete solution or cure-all to the high altitude, high performance traffic control problem as it exists today. It will establish some fundamental principles and provide valuable experience for the ultimate requirement of positive control at altitude."
- **S. P. Saint:** "It's time we got serious about Automatic Air Traffic Control. We need automatic machines to speed up the routine functions of control. We need such machines to keep the mushrooming ATC operations safe . . . In the system I visualize, aircraft will report position automatically. A machine on the ground will analyze control data automatically. Routine clearances will be automatically prepared and transmitted to the cockpit for display on a visual indicator. The automatic system we need, is not a

system that replaces the human judgment of either pilots or controllers. Quite the contrary. It should relieve the pilot and controller of the routine, repetitious functions of control. This will permit even greater freedom in the exercise of human judgment when this is required. There must be no compromise with the pilot's prerogative to say when a flight will operate, to what destination. The pilot must have complete freedom to say when a flight will divert to an alternate. This responsibility is his alone. It cannot be shared with ATC."

Airport Panel

Capt. E. A. Cutrell, who was the leading figure in the development of the ALPA Centerline Approach Lighting System, emphasized some serious airport shortcomings and inadequacies. He said that some of the most serious accidents occur at or near airports.

He blamed airport inadequacies for mishaps occurring in landings and take-offs, such as undershooting or overshooting and near misses, skidding on icy or wet runways, and during circling approaches.

Foremost Need Stated

One of the most important things needed by pilots, noted Cutrell, are the proper tools for transition from instrument to visual flight to enable safer landings in restricted visibility.

"This," he said, "is a realm where much can be done to improve airport safety, and serious consideration must be given to the early implementation of the best possible visual aids at all airports where turbo-jet and jet planes are to be operated. Both radio and visual aids for opposite direction approaches will be extremely important for landing these planes."

"The United States," Cutrell continued, "has been backward in installing dual direction landing aids at even our most congested terminals. We have struggled along with barn-storming techniques of circling approaches and tail wind landings up to this time with our single direction approach facilities."

By contrast, he pointed out, London Airport has radio and approach lights in four directions; in Canada, major airports, like Montreal, are provided with two instrument landing approach light systems.

Capt. Cutrell headed the Airport Safety Panel, made up of Herbert O. Fisher, Chief, Aviation Development Division, Port of New York Authority, who spoke on "Airport Efficiency and Safety"; Vice-Adm. Charles E. Rosendahl, Executive Director, NATCC:

EVACUATION PANEL: J. E. McKenna, E. G. Norris, J. F. Avellar, Dr. B. King, H. D. Kysor, W. L. Alford.

"The Airport Noise Problem"; Robert Aldrich, President, Airport Operators Council: "Airport Safety — AOC's Views"; A. M. Johnston, Chief of Flight Test, Boeing: "Boeing's Views on Airport Requirements for Jet Transports"; and John F. Martin, Chief of Flight Test, Douglas: "Douglas Views of Jet Airplane Operational Requirements."

Some highlights:

▶ **H. O. Fisher:** "It is axiomatic in planning for the handling of any traffic, whether it be ground vehicles, ships or airplanes, that congestion always jeopardizes safety and that adequate facilities and the most efficient handling possible of the traffic are necessary to provide a safe operation. Therefore an airport operator is promoting air safety, when he plans for efficient handling of air traffic at his terminal . . . The magic measure, which serves as a criterion of efficiency of airports, is 'acceptance rate' . . ."

▶ **Vice-Adm. Rosendahl:** "In the course of my duties, I follow closely the developments in the field of jet noise suppression for civil transports. A year or so ago, frankly, my feeling was one of doubt. Today, however, I feel quite confident that the two great civil jet transports now on order, will arrive on the scene with devices for keeping their outside noise to values comparable to those of today's aircraft, and acceptable to the community."

▶ **R. Aldrich:** "We find today virtually no clearing house for the working out of all of the problems and location of ideas and thinking for the industry. We therefore have to do the best we can, with what we have. This indeed is a poor commentary on anything as important as air transportation to the future of the United States of America. Let's start now to find a common ground of mutual understanding and cooperation so that for every new, worthwhile idea we will not find already organized counter ideas, and what is even worse, organized, muscle-bound lethargy."

Capt. Harley D. Kysor, ALPA Emergency Evacuation Study Committee member; Dr. Barry King, CAA, Chief of Medical Division; R. J. Schroers, Chief of Structures Branch, CAA; W. L. Alford, Flight Research, NACA; J. F. Avellar and J. E. McKenna, Air Cruisers, were members of a panel on Evacuation and Survival.

Evaluation Panel

Capt. Kysor spoke on "Passenger Evacuation and Survival—A Pilot's Viewpoint"; Dr. King: "Developments in the Emergency Escape Problems"; R. J. Schroers: "Crash-Resistant Fuel Tanks—One Answer to the Crash Fire Problem"; W. L. Alford: "Airframe Marking for Evacuation"; J. F. Avellar and J. E. McKenna: "Evacuation Problems—Gear Extended."

Also on this same theme, E. G. Norris, Boeing Airworthiness Engineer, showed a film on evacuation tests conducted by his company.

Items:

▶ Pilots must be completely familiarized with all problems concerning evacuation, in case of a crash. So should be all passengers.

▶ Tests show that it is possible to transfer passengers from an airplane, ditched at sea, to life rafts within 90 seconds.

▶ CAA tests indicate that development of virtually unbreakable fuel tanks is possible.

Cockpit Instrumentation Panel

Capts. J. J. Kelley (EAL) and W.

C. J. Lowen (left) and E. P. Curtis (right) with Pres. Sayen.

L. Hitt (BNF) and David S. Little made up the panel on Cockpit Instrumentation Standardization.

Other speakers addressing the gathering included Cliff Burton, Technical Representative, Federal Telephone & Radio Co.: "TACAN Development"; Jerome Lederer, Director, Flight Safety Foundation: "Meeting The Challenge of Air Safety"; Maj. Thomas Savage, Chief Operations Officer, Strategic Air Command: "Jet Transport Operation Lessons from SAC"; G. E. Rice, Aerojet Corp.: "Improving Flight Safety With Auxiliary Rocket Engines"; A. Paul Vance, Monsanto Chemical Co.: "Skydrol and Its Usage"; Jack Real, Flight Test Engineer, Lockheed: "Lockheed Electra Airplane"; Jim Beaumont and Francis Conn, Technical Representatives, Allison: "Allison 501 Engine and the Aero Products Propeller"; and Capt. H. W. Atkins (NWA): "Stroboscopic Light for Aircraft Exterior Lighting." H. Harrison, Chief Metereologist, United Air Lines and M. Balzer of UAL's Flight Operations exhibited United's "New Look" film on Airborne Radar.

CAA Administrator's Address

One of the highlights of the three-day gathering was a banquet held Wednesday night March 7. Among the distinguished guests present, was Charles J. Lowen, recently-appointed Civil Aeronautics Administrator, and Edward P. Curtis, Special Assistant to the President for Aviation Facilities.

Lowen in his address bared a four-point program for improving the air traffic control system.

He announced, that the CAA was taking a first step toward automation with installation at its Indianapolis Air Route Traffic Control Center of an IBM data processing machine and printer.

He revealed CAA plans to acquire a B-47 and later a civil jet transport, which would be used in simulated airline service, to study aerial and ground handling problems of jets.

Air traffic control is to be elevated to the status of a separate office within CAA, Lowen said, to give it the necessary power to accomplish its mission.

The Administrator also proposed CAA control of all airspace in the higher altitudes, pointing out that it would require installation of 69 long-range radars by 1961 as called for in the President's budget message.

"This nation can buy whatever degree of traffic control it is willing to pay for," he said. "I believe that American public opinion is awakening to the urgency of the problem; that there is a growing demand for an action program to maintain order on the skyways; and that we are going to get the tools we need to meet this great challenge."

Curtis, in a short message of greeting, pledged the fullest cooperation of the Administration in the solution of the nation's aviation problems.

During the dinner, a special plaque was presented to Pres. Sayen by Vice-Adm. Rosendahl on behalf of NATCC, in recognition of the ALPA President's efforts to promote the cause of aviation.

Capt. Robert A. Stone acted as Master of Ceremonies at the banquet. Capt. L. Homer Mouden was M. C. of the Forum proper.

Meet Your Officers

Wylie H. Drummond

Wylie H. Drummond assumed his duties as Regional Vice President of Region V on July 31, 1955.

His ALPA activities have included Chairman, Council No. 50 (three terms); Member of the System Board of Adjustment; Chairman of the Negotiating Committee; Chairman of the American Airlines MEC; Witness, (for Reserve) Presidential Board, AA, 1950; Witness, Cole Hearings, Cornell University (eight-hour dispute).

Drummond was born and educated in Jackson, Tenn., attending Lambuth College for three years, with a prerequisite in law. From 1934 to 1939, he represented an investment banking firm in the State of Tennessee.

His flying career began in 1939 in the U. S. Army Air Corps, soloing in December, 1939 in a PT-3. After working for a flying school in Colorado, he became a pilot for American Airlines in January, 1941.

In February, 1941, he married an American Airlines stewardess and they have two children—a daughter, 10 and a son, 8. Since July, 1954 they have made their home in Los Angeles.

During Capt. Drummond's employ with American Airlines, he has flown all of their routes including the Air Transport Command (North Atlantic); Contract Air Cargo Division (Alaska); and the Korean Air Lift.

'The Black Hole'

A Vital Discussion Of Low-Visibility Approach And Landing And Design Configuration Of Visual Aids In Relation To Limitation Of The Human Eye

By Arthur E. Jenks
Chief, Flight Inspection Division, CAA

The primary purpose of this article is to highlight the visual portion of the approach and landing of aircraft under low visibility conditions. An attempt has been made to state the problem in its various components and propose a method of solution, that is compatible with the limitations of the human eye. To accomplish this, we take you through the problem, the components of the proposed solution, and, last, expose you to a brief analysis of the eye and its function. The last is the key to the other two: simplicity is the order of the day, especially when you consider that the operational application of this discussion takes place in 10-15 seconds.

Before any analysis of a specific portion of the over-all problem can be determined, certain assumptions are necessary in order to stabilize or neutralize the remaining factors of the over-all problem. This article is directed to the visual portion of the problem and it is assumed that the factors of stability, speed, drag configuration of the aircraft, attitude and all the other factors pertaining to a successful approach and landing are satisfactory or under control.

Factors Involved

In this condition, we are dealing with a common velocity of the aircraft, the approach speed, and this speed or velocity constitutes a rate of movement that is ahead and down. It can be deviated right and left and the vertical component can be adjusted to conform to the prescribed approach slope.

Previous work has shown that the preferred slope as determined by visual reference to the geometry of the runway pattern was approximately 2.8 degrees. This was obtained from controlled observations of random approaches made visually by six different types of "T" category aircraft.

Visual adherence to the approach slope is no particular difficulty, providing that certain basic elements of the geometric pattern are available in the visual field and deviations or corrections can be made readily with no appreciable delay or response factor.

Alignment of right/left deviation of the velocity is critical insofar as the time factor is concerned. The time required for the correction and the correction termination are not available at low visibilities unless much of the landing surface is sacrificed in the correction process.

The field of vision from the pilot's eye level in "T" category aircraft is adequate for the operation involved (approach and landing). By this is meant, that any enlargement of the cockpit visual field for various and justifiable reasons (ground handling of aircraft, vfr collision avoidance, etc.) would produce no appreciable improvement in the present approach and landing problem.

Visual Flight Requirements

The basic requirements for visual flight in the approach zone are: Identification; Alignment; Roll Guidance; Height Guidance; Distance; Positive Threshold Definition. These elements must be presented with a simplicity, requiring no interpretation, and must be obtainable instantly, when needed. Under lower visibility conditions the time element is critical and will not permit of any signal other than a positive and instantaneous rendition of the required element.

After passage of runway threshold, the requirements for visual flight for flare, touchdown, and landing roll are: Identification; Alignment; Adequate definition of runway surface plane (Precise height sensitivity); Roll Guidance; Distance. The requirements for visual flight over and onto the runway are in many respects similar to the approach requirements, although differing in order of priority and with strong emphasis on precise height sensitivity. The requirements for adequate identification, alignment and roll guidance are in no sense decreased. At the present time, the visual information changes abruptly at the threshold and becomes inadequate and in many cases, entirely absent. The main reason is that with good approach lighting, containing the required elements for visual flight, the abrupt change at the runway threshold to the outline of the runway geometric pattern affords no continuity of the elements, previously present.

Approach Patterns

It has been established that visual flight can be maintained on an acceptable approach light pattern with a minimum visual segment that is the equivalent of three seconds of time at the aircraft's forward velocity. At an approach speed of 140 knots, this would be the equivalent of a 700 ft. visual segment ahead of the aircraft (711 ft. exactly). It has also been established, that difficulty is experienced on the runway in landing if the visual segment ahead of the aircraft is less than 1,400 to 1,900 ft., dependent on the runway width. This indicates, that whereas the minimum segment of three seconds will suffice in the approach zone, the requirement increases to 6-9 seconds over the runway for the principal reason that there is no continuity of the visual intelligence, obtainable in the approach zone, on to the runway. The following table will be referred to later in this article. It is introduced at this time, because the statement has been made that the minimum useable visual range on a runway is apparently associated with runway width.

Required angular vision..	2,500 - 4.6°
to encompass both sides	2,000 - 5.75°
of 200 ft. runway at dif-	1,500 - 7.6°
ferent visual ranges	1,000 - 11.3°
150 ft. runway.....	2,500 - 3.43°
	2,000 - 4.3°
	1,500 - 5.73°
	1,000 - 8.53°

Basic Runway Needs

Any theory of adding extra guidance elements into the visual aids pattern, particularly those that require pilot interpretation should be screened carefully. The principal reason for pilots not accepting the slope-like system was its requirement for interpretation. The visual aids system should be considered only as requiring three basic units for instinctive interpretation: (1) Approach, (2) Threshold, (3) Landing

Mat. Instinctive interpretation means that these three units should be treated in such contrasting fashion that, at no time, could one be mistaken for the other two whether visible or not. Even the introduction of distance information should be very sparingly used in order that progressive reaction of the pilot's mind will be left free to keep ahead of the airplane on approach and landing using the visual air guidance elements of height, roll and direction instinctively.

For identification, a distinct change in the centerline configuration is required. At present this change is noted by the transition from a solid visual reference to something vague and indefinite (in the lower visibilities).

Alignment

In the higher visibilities, 2,000 ft. RVR (Runway Visual Range) or more, alignment can be obtained from the definition of the landing surface limits (runway edge lighting) but in the lower visibilities and particularly at the runway working altitudes, 70 ft. or less, alignment is difficult to obtain due to the secondary indication of "X" (in this case the runway centerline), furnished by the runway edge lighting. At the eye height in landing (20 ft. approx.) alignment intelligence is critical, particularly with any substantial crosswind component, for it is here that the crab angle resulting from crosswind drift correction must be removed and the aircraft heading and the track heading must coincide within a very few degrees (approx. 3° ±).

For roll guidance, at present, there is no direct and simple horizon indication on the runway. Over the approach area the pilot could obtain this from the transverse bars in the configuration; but over the runway sufficient visibility is required to obtain this information in a secondary form from such objects or combination of objects that are visible.

Height Guidance

Height guidance at present is derived from several sources and at the best is an indirect geometric perspective reading that the pilot has learned, through experience, to use as a height gauge. Information is obtained from the visual presentation afforded by the runway edge lighting and dynamic appearance of runway surface texture below the aircraft. As altitude is lost from the threshold crossing height to landing height the runway edge, as determined by lights, moves upward and outward, simultaneously the spacing between lights appears to shrink or close. These features together with the increasing flow rate of any discernible texture of the landing surface, are the primary aids in judging height over the runway. Secondary assistance is provided by reference to such items that may be visible outside the landing surface boundary. These objects are in the pilot's parafoveal visual field at this point, because his primary visual attention is ahead, and any visual significance of these objects in the landing operation is of minor importance. I believe it was originally noted by Capt. Majendie, then with BOAC, that the eyes of a pilot during the final flare and actual touchdown employed no saccadic movement, but instead stared directly ahead. This was later explored and confirmed by several research organizations specializing on the landing of aircraft and became known as the "stare period."

Visual Distance Signals

Visual distance signals are a definite need in low visibility operation. The principal uses of this type of indication are: (1) Constant assessment of visual range, particularly during final flare-touchdown and initial landing roll; (2) Definition of the landing direction limit of touchdown area; (3) Definition of the upwind end of runway or proximity thereto.

Foveal Visual Field

The writer has asked competent medical authority for the angular definition or limits of the foveal visual field and so far has been unsuccessful in the placing of finite geometry on this phase of vision. From analysis of weather approaches, personal experience, study of the papers Mr. Calvert has written, "Visual Aids for Landing in Bad Visibility with Particular Reference to the Transition from Instrument to Visual Flight," "Visual Judgments in Motion" (Note: These are the most significant papers to date on this subject), and a layman's research in the field of optics, some conclusions are apparent at this time. The validity of these conclusions remains to be proven, but they are stated here for discussion purposes:

▶ The area of foveal vision cannot be definitely described in mathematical terms because of the varied opinions expressed by competent authority. It may possibly be due to the lack of common interpretation, i.e., the medical man may have difficulty in transposing a pilot's interpretation of his visual reactions into optical language.

▶ It is apparent that the area of foveal vision is considerably smaller than the "white dot" area of the normal visual field. The "white dot" area covers approximately 25-30 degrees.

▶ It is also possible that the area of foveal vision may vary with individuals (normal vision).

▶ From low visibility landing test work, the level of difficulty associated with a normal landing rises abruptly when the runway visual range on a 200 ft. wide runway decreases below approximately 1,900 ft. and on a 150 ft. runway when the RVR goes below 1,400-1,500 ft. In both of these cases the angular spread between the lights on the runway edge at the extreme visibility limit is a little more than 5 degrees. (See Reference Table above.)

▶ Low visibility landing test work has shown inadequacies of elevated runway edge lighting, under conditions of light to moderate fog, in providing elevation information or even sufficient visual clues to provide any definition of runway surface plane for final flare and touchdown.

▶ Several items of importance are apparent: (1) The area of foveal vision when the eye is focused on infinity is 5 degrees or less; (2) There is no fixation point at the place where the pilot wants and needs it, i.e., the continuity of "X"; (3) Under the conditions previously described, the main visual assistance is derived from the parafoveal streamer vision and this, in itself is abnormal to the pilot because normally he has and uses both visual fields.

Pilot Experience

Visual height determination is from the perspective determination of the geometry of the runway pattern, which the pilot has learned from experience. Under low visibilities, the runway pattern was not visible in sufficient time or detail to make flight path corrections and still have enough runway to land and stop on. This was the principal reason for approach lights and of the many configurations tried, the successful ones were those that carried the principal geometric elements of the runway pattern out into the approach zone. The centerline and crossbar systems do this and the visual information is instantly obtainable, with no time lost in the pilot's visual interpretation.

The average angle of present-day electronic instrument approach slopes is 2.8 degrees. As previously pointed out, the average angle of observed visual approaches by random "T" category aircraft was also 2.8 degrees. The instrument and visual paths, apparently coincide but in actuality, whereas both have the same slope, they terminate at different points on the runway. The instrument approach slope terminates

approximately 1,000 ft. down the runway from the threshold and the visual approach slope terminates on the runway side of the threshold.

Undercutting The Glide Slope

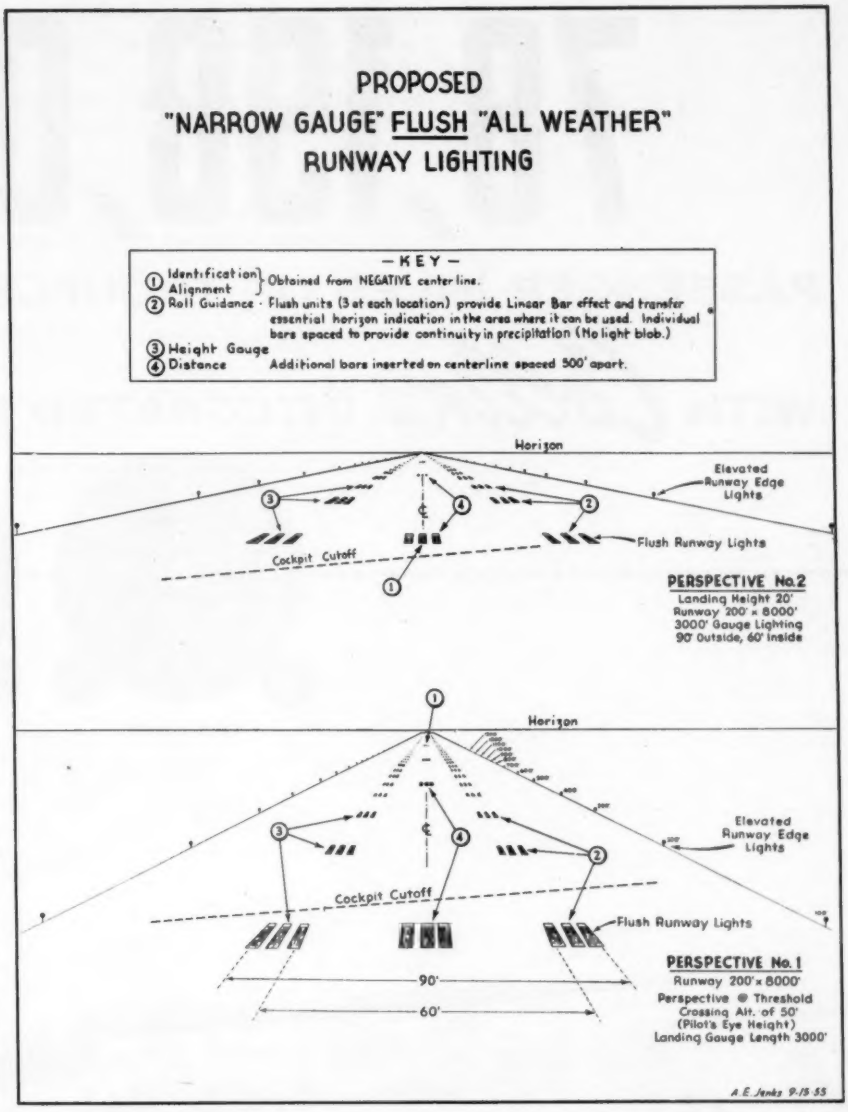
Why do pilots normally undercut the glide slope (both electronic and visual) under poor visibility? Generally speaking, pilots adhere to the electronic glide slope until the visual approach or landing aids come into view. If a sufficient segment of the visual aids is available the complete transition from instrument to visual flight is made. The localizer and glide slope are of no further interest or concern.

If, for any reason, an adequate visual segment is not available or insufficient guidance elements are present within the segment, the approach is then or very shortly thereafter abandoned and a missed approach procedure initiated. In either case, the electronic glide slope is of less than academic interest, under these conditions.

The best way to assess this condition is from experience and observation of other pilots making weather approaches. Again, the normal visual approach angle is 2.8 degrees and anything above or below this reads "TILT" to the pilot and he endeavors to correct his flight path accordingly. Under reduced visibility and after becoming visual, the pilot will have a minimum segment of lights to proceed on. He will have the elements of Identification, Direction and Roll Guidance, but his height assessment is incomplete if the angle of the extreme forward limit of his visual field is greater than 2.8 degrees. At this point his visual picture reads "TILT" insofar as height judgment and he will decrease altitude accordingly. Some idea of the relationship of the 2.8 degree slope and various visual ranges are as follows:

Visual Range	Altitude
2,000	98'
1,800	88'
1,600	78'
1,400	68.5'
1,200	58.6'
1,000	49'
900	44'
800	39'
700	34'

Under visual ranges of less than 2,000 ft., the pilot may become visual well out on the approach system and lose altitude until he obtains maximum height sensitivity, which will be somewhere near the figures quoted above. At this point the flight path descent is checked and aircraft flown in on top of the lights. This is a perfectly safe procedure as long as pads of speed or power are maintained.


PROPOSED
"NARROW GAUGE" FLUSH "ALL WEATHER"
RUNWAY LIGHTING
— KEY —
1 Identification } Obtained from NEGATIVE centerline.
Alignment
2 Roll Guidance - Flush units (3 at each location) provide Linear Bar effect and transfer essential horizon indication in the area where it can be used. Individual bars spaced to provide continuity in precipitation (No light blob.)
3 Height Gauge
4 Distance Additional bars inserted on centerline spaced 500' apart.
Horizon
Elevated Runway Edge Lights
Flush Runway Lights
Cockpit Cutoff
PERSPECTIVE No.2
Landing Height 20'
Runway 200' x 8000'
3000' Gauge Lighting
90' Outside, 60' Inside
Horizon
Elevated Runway Edge Lights
Cockpit Cutoff
Flush Runway Lights
90'
60'
PERSPECTIVE No.1
Runway 200' x 8000'
Perspective @ Threshold
Crossing Alt. of 50'
(Pilot's Eye Height)
Landing Gauge Length 3000'
A.E. Jenks 9-15-55

Guidance Achievement

The proposed configuration, when examined under close scrutiny for each of the desired elements, has each element in sufficient detail and repetition, which will allow safe visual operations to exceedingly low limits. Examination of each element follows:

▶ **Identification:** The closely spaced double rows of bars form a positive break in configuration. Over the approach zone the pilot corrected or held his instrument flight path alignment by closing on and holding the extended centerline of the runway as defined by the approach lights. With the proposed configuration, the centerline is continued from the threshold plus 3,000 ft. by the negative centerline indication between the parallel rows of bars. This break in centerline information from positive to negative leaves no doubt that this is the runway. This is particularly important in operating in the lowest visual ranges, where the visual transition would occur very close to threshold.

▶ **Alignment:** Obtained easily from the negative indication of centerline. The foveal visual field when centered on the maximum visibility limit (in this case let's assume 1,200-1,300 ft. slant range) covers an area embracing both linear light sources and due to the tangential angle of the visual axis and the runway surface, the surface area covered by the foveal visual field will extend from 500 ft. ahead to the horizon. Without the addition of the runway narrow gauge lights, there is noth-

CAPITAL AIRLINES REPORTS . . .

78,198,000

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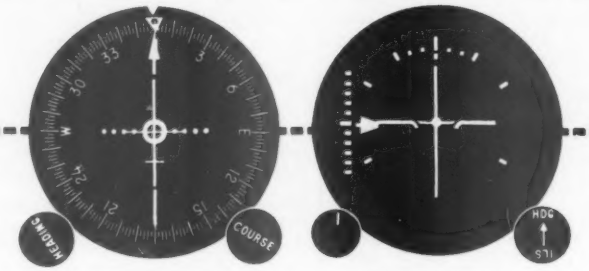
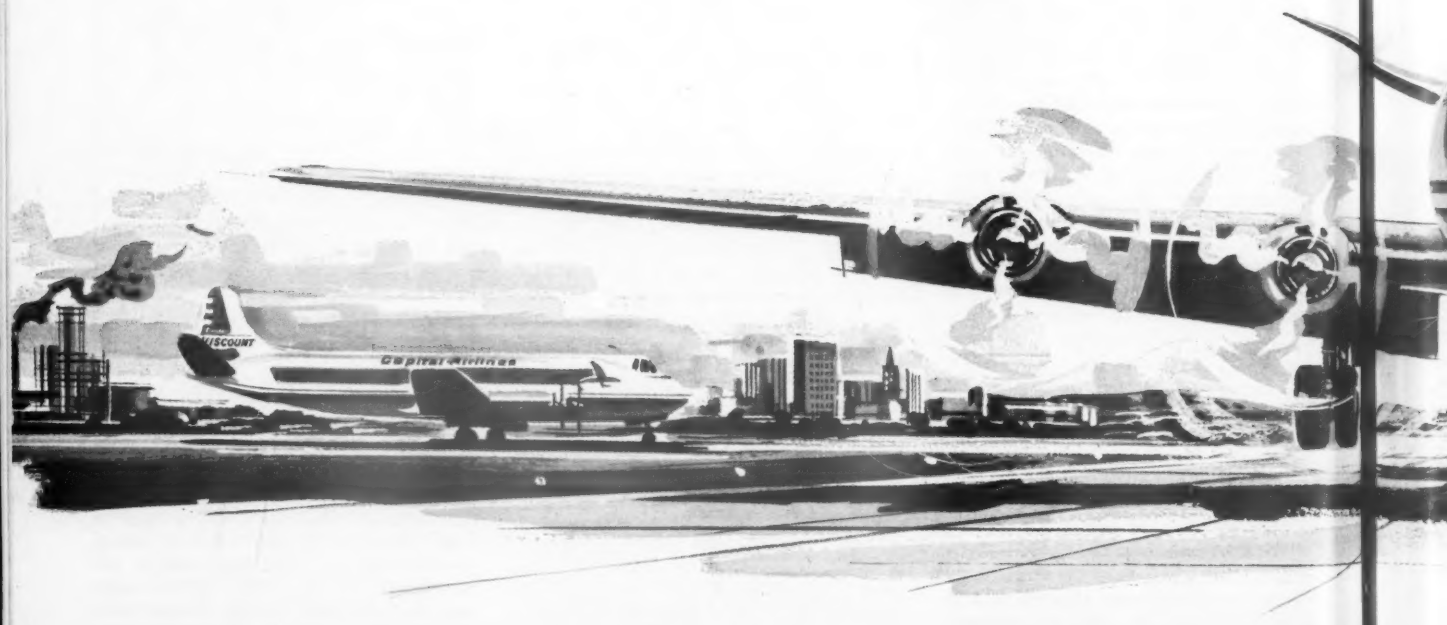
WITH *Collins* INTEGRATED FLIGHT SYSTEM



COURSE INDICATOR APPROACH HORIZON



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Mr. Earl Raymond, Supervisor, Instrument and Electronics, says:

"In 78,198,000 passenger miles, no time has been lost because of unscheduled removals of Collins Integrated Flight System.

"During the period our IFS equipped Viscounts have been in service we have had 751 ILS approaches without a single missed approach.

"We have been thoroughly pleased by the unsurpassed reliability of the components of the Collins Integrated Flight System."

Capt. Ralph Read, Chief Pilot, says:

"The Course Indicator's graphic presentation makes for easy approaches during low visibility — convenient to set up and simple to understand.

"Easy to detect pitch and bank errors; easy to cross-monitor; less chance of missetting.

"In heading function, Approach Horizon makes enroute flying less tiring.

"Use of Course Indicator while 'holding' reduces fatigue.

"Automatic cross-wind correction simplifies ILS steering.

"Use of Heading Marker and Steering Needle makes radar flying more precise.

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ing in the area of foveal vision to fix on and this has undoubtedly contributed to the definition of this area in a low visibility landing as the "hold off and hope area."

▶ **Roll Guidance:** This is easily maintained by easy-direct reference to horizon continuity formed by the paired transverse linear light sources. It makes lateral stability reference a simple reading while in the flare and touchdown stages of landing. With the present type of runway lighting, information of this type is deficient at best and under lower visibility conditions, non-existent.

▶ **Height Guidance.** As explained earlier the features of the normal runway geometric pattern, that a pilot uses for height guidance, are vague and diffused under the lower visual ranges for simple reason *that what he can see is not located where his aircraft will traverse in the next few seconds.* The precise definition of runway surface plane, which is required for accurate visual judgment of height, for final flare and landing, is lost. He has no visual aid. With the proposed configuration, he has a solid height gauge, mainly the apparent increasing separation of the two rows of linear bars as he descends plus the flattening or closing of the distance between bars (as he sees it). Under normal visibility he has this picture on a larger scale. The proposed configuration will supply this scale in the reduced visual range area and also provide adequate, textured, runway surface plane marking.

▶ **Distance:** This type of information can best be interpreted in the proposed runway treatment by the ending of the guidance elements at a specific distance (3,000 ft. from runway threshold) to avoid the use of added elements for pilot distance interpretation. Definition of the upwind or far end of the runway will generally be accomplished by viewing elements of visual aids used primarily for the opposite direction approach.

Limitations Of The Human Eye

In many respects there are many similarities between the eye and a camera, the main purpose for comparative reasons is that every camera has limitations and so does the eye. To understand these limitations and allow for their consideration in the design configuration of visual landing aids, is the purpose of this discussion.

The human eye is almost spherical in its over-all aspect and consists of tough elastic membrane, which encloses the lens, the iris, and the retina. The lens acts as a division or separation point between the front and rear portions of the eyeball and is located about one-fifth of the eye's diameter from the front. The space between the lens and the forward part of the eye is filled with a clear liquid called aqueous humor. The space behind the lens is filled with a jelly like substance called vitreous humor. These two liquids give the eye its required inflation to spherical form and without them the eye would collapse. The rear inside portion of the eyeball is called the retina and it is here that the transformation of light waves into nerve pulses, that the brain can interpret as vision, takes place.

The lens and the iris, in effect control the quality and amount of light transmitted or passed onto the retina.

The whole operation of focusing and directing the eye is controlled by six muscles arranged in such a manner that the eye can be moved up, down, right and left and at the same time can be slightly expanded or contracted, the latter movements control with minute effectiveness the distance between the lens and the retina, which constitute focus.

The Retina

The operation of the lens and the iris have sufficient photographic comparison as to need no further explanation here, i.e., the same principles apply. The retina can be compared *roughly* to the photographic film. Actually, the retina is composed of ten layers of tissue and in the deepest layers are located the tiny nerve ends, called rods and cones that transmit the light impulses to the brain via the nerves or neurons. These rods and cones are protected by the layers of tissue except at one small spot near the center, called the fovea. The fovea is a small pit or depression about the size of the head of an ordinary straight pin. In this area the upper layers of retinal tissue are non-existent and the cones are exposed to light. The distribution and density of the cones and rods over the area of the retina is of extreme interest in the study of acuity throughout the visual field. In the foveal area itself, the cones predominate and the density ratio is approximately 160,000 per square millimeter. In this area each cone has its own neuron, whereas at the outer periphery of the retina the density drops to approximately 1,000 cones and rods per square millimeter and several rods plus a cone are grouped to one neuron. In the remaining retinal area the light must penetrate the protective layers of tissue before reaching the cones and rods. This means that in the normal eye, there is a central area of vision that is sharp and clear (foveal vision). Vision deteriorates rapidly in proportion to the angular departure from the center of foveal vision and this area is termed parafoveal vision.

The eye, in transmitting the visual picture to the brain, scans the area of attention by movement incurred by muscle actuation simultaneously adjusting the eye focal length as required. Also, the entire retinal presentation, the combined output of all the cones and rods, is flashed to the brain via the optic nerve at rates varying from 40 to 150 times per second.

On the nasal side of the retina is a point where the optic nerve enters the eyeball. This point of entry creates a small area that is devoid of cones and rods and is called the blind spot. Although the blind spot is on the nasal side of the eye, the area shows in the visual field at approximately 25-30 degrees outward from the visual axis and slightly below the lateral centerline. This is due to the inversion of vision by the lens.

Decrease In Visual Acuity

Earlier in this article, it was pointed out that the area of sharp, clear vision is quite small and there is a gradual decrease of visual acuity as the angular departure from visual axis is increased. This is due to three reasons: (a) The slope of the retinal tissue adjacent to the fovea; (b) The decreased density of the rods and cones proportionate to the distance or departure angle from the fovea; (c) The transition from a 1-1 ratio of cone/nerve coupling in the foveal area to a 4-1 ratio of rods and cones to a single nerve at the outside perimeter of vision.

In an effort to factually determine the angular spread of the foveal vision area, we can arrive at a reasonably close figure by the following. It was stated in most of the reference material that the dimension of the fovea was comparable to the head of an ordinary straight pin. Also, the focal length of the average eye was 1⅛ inches. By micrometer measurement of a series of pin heads we have dimensions ranging from .046″ to .0565″. If we use an average dimension of .051″ and the eye focal length of 1.125″, we arrive at a sine ratio that equals an angle of 2.6 degrees.

Whereas the foveal vision area is sharp and clear, the parafoveal vision is sensitive to change or motion. Colors are sensitive in parafoveal vision, possibly due to the difference in wave length compared with white light. To summarize, we can say that in a normal eye we have a small area of sharp

clear vision which represents 3-5% of the entire field of vision and while looking straight ahead the area of clear vision is approximately centered in the visual field. Vision deteriorates rapidly in the remaining area to practically nothing at the extreme edge.

Binocular Vision

So far we have only considered the function of a single eye. When consideration is given to the coordination and tracking of a pair of eyes, the complexity and accuracy of control far surpass any comparable electronic circuit.

In normal vision, the eyes track simultaneously, i.e., the visual axis of each eye is centered exactly on the focal point of the moment. Some idea of this may be obtained from a comparison of two focal points in the same line of vision. Look at some small, sharply defined object five or six feet away. Now introduce another object about 15 to 18 inches away from the eye and on the direct line of vision between the eye and object No. 1, (the point of a pencil will do) now shift attention to object No. 2 and note the decrease in vision of No. 1.

Crossover Network Of Optic Nerves

Another feature of the complexity of the eye control and visual interpretation by the brain is the crossover network of the optic nerves. As a comparison, we can say that the optic nerve from each eye has four channels. Two channels, from each eye, go to the right side of the brain and the remaining two from each eye go to the left side of the brain. Each side of the brain has half of each eye's vision. The millions of nerve fibers involved in this operation fuse the images from each eye into the single image that we are accustomed to. The visual fields of each eye overlap sufficiently so that the visual field of one eye covers the blind spot of the other.

Another interesting sidelight in the study of vision and how it is achieved, is the fact that vision is founded on education as much as anything else, i.e., the actual mechanics of vision may be present but without the brain function it is useless. An excellent example of this is the case histories of otherwise normal intelligent individuals, who have had the misfortune to be blind since birth. In certain instances vision has been restored to these individuals by means of surgery; namely, a corneal transplant. After the required healing period the bandages are removed and the individual is exposed to the visual world for the first time—all is confusion—colors are meaningless, the definition of familiar objects by visual means is fruitless. When asked to visually identify the edge of a table or key from an assortment of objects, it cannot be done, yet when the individual's hand is placed on the edge of the table or allowed to hold a key, recognition is instantaneous. In a normal existence the visual education is progressive from birth, consequently the exposure to some new visual experience can be assimilated in the normal stride unless it is too marked a departure from normal development. In such instances a period of education is required.

Evolution Traced

If we apply the above to the approach and landing problem, we can trace the evolution in this manner:

- The average airline Captain of today has between 8,000 and 10,000 hours of flying experience.
- In his career he has made at least the same number of landings (8-10,000) possibly many more; the point is that the landing maneuver is not new to this individual.
- The greater portion of these landings have been made in daylight and in reasonably good visibility, a lesser portion are at night under conditions where the familiar runway geometric pattern is carried in outline by lights and the necessary ground plane texture picked up by the aircraft landing lights.
- Very small percentage of the total number of landings are under poor visibility conditions either day or night.
- The modern, high-performance transport requires a very high degree of visual judgment, split second interpretation and decisions on the part of the pilot handling the controls, regardless of weather conditions.

Under the type of conditions being discussed, we are requiring a pilot to act as the brain of a beast that requires a high order of visual judgment to safely effect the transit of air to ground. Under the conditions set earlier in this article, he has visual guidance over the approach and then has it deteriorate or become entirely absent over the runway, where he is in the critical portion of landing. The requirements of the inanimate beast he is controlling, do not relax to meet this condition and the pilot finds himself in much the same predicament as our individual with the restored sight. What little he can see, the illusions that can develop in a fast moving dynamic picture that is incomplete are beyond the pilot's visual experience and the result is confusion and inevitably trouble. The few seconds available in this situation are insufficient to visually reconcile the required necessary judgements with the associated finesse.

Brain As Computer

For our purpose we can consider the brain as the computer, that takes the visual information that is fed to it, analyzes it and then sends the appropriate muscle pulse for the required action, plus storing it in the memory circuit for a period of time. In applying the mechanics of the eye to the visual portion of approach and landing, we cannot overlook the fact that this is strictly a rudimentary analysis and to fully explore the factors affecting vision as it relates to this operation would require extended research delving even into the psychic. However, by applying the simple mechanics of the eye, plus experience in the approach and landing problem, one can distinguish and isolate the various portions of the problem and arrive at reasonable solutions.

The area of foveal vision has a spread of 3°+.2°—.5°. This area of sharp clear vision is less than 5% of the normal visual field. Considering only the visual portion of a low visibility approach, the pilot while over the approach zone does some scanning with the eyes and as the threshold is approached, the attention is concentrated directly ahead. Upon crossing the threshold (under low visibility conditions and with present runway lighting standards), there is no visual assistance in his foveal vision field. He is now in the critical part of landing, the final flare and touchdown. Research has proven that the pilot's eyes in this portion of flight stare directly ahead. Under normal visibilities he is using both foveal and parafoveal vision at this point, but under low visibility his visual cues are extremely weak in the present runway treatment. This is further aggravated by the fact that in a stare condition foveal vision deteriorates for having no focal point. This could account for the fact that on test work with 3 and 4 pairs of trained eyes in the cockpit, one person would see certain lights and objects and another would not and vice versa. The proposed configuration will provide visual aid in the foveal visual field down to visual ranges of less than 1200 feet. In visual ranges of less than 1200 feet down to the lowest operational range, it will provide strong and adequate signals in the parafoveal vision field and leave a dark spot for foveal vision fixation.

The foregoing is an effort to demonstrate the thinking and reasoning in developing the proposed runway configuration.

New CAA Civil Aviation Program

Four-Point Program Of New Administrator With Emphasis On Traffic Control, Is Revealed To Nation For First Time At ALPA Safety Forum

By Charles J. Lowen
CAA Administrator

I was appointed Administrator of Civil Aeronautics not quite three months ago. All my experience since then has confirmed my original impression that our Number One problem is air traffic control.

The fact that we really have a big and complex problem here does not need to be labored. The subject has been examined from every angle in conferences, committees, symposia, and bull sessions. We have universal agreement that something must be done, and we have almost as many suggestions for a *future* traffic control system as we have pilots.

Immediate Problem

But we in the Civil Aeronautics Administration are confronted with the *immediate* responsibility of making the traffic control system work — today, tomorrow and the next day. We have to seek improvements even as we continue operations. After taking a long, hard look at the problem, I am now prepared to take positive action along four lines:

- Organization,
- Familiarization,
- Automation, and
- Information.

Organization

It is no secret that I have been studying the advisability of establishing an Office of Air Traffic Control in CAA. As you know, traffic control at present is a part of the Office of Federal Airways, along with the engineering, maintenance and inspection of air navigation facilities. I have now decided to elevate the air traffic control function to the status of a separate office.

In so doing, I hope to accomplish two things. First, I want to give the traffic control group all the prestige and power they need, not for personal aggrandizement, but to get things done. Second, I want to reverse completely the approach of having the operations of the air traffic control system governed by the kind of tools the engineers give the operators. It seems to me more logical that the men, who have to operate the system should develop broad performance specifications for the equipment they need, and that then the engineers should apply their ingenuity and skill to devising and perfecting such equipment.

For such an arrangement to work, of course, our operations people will have to be both imaginative enough to think in terms of new methods where new methods are necessary, and practical enough not to demand the impossible.

This organizational plan in no way relegates our airways engineers to a position of secondary importance. They will retain the status of top-level office, reporting directly to me. Freed of the taxing demands of administering a 12,000-man communications and control organization, they should be able to come up with some real accomplishments in their professional field. We are counting on them for significant contributions to the advancement of the art, and I do not think they will disappoint us.

Familiarization

Let us face it. No one in this country except the military has had any substantial operational experience with jet aircraft. True, we have been able to send some CAA people through the Air Force senior officers' course in jet instrument flight indoctrination, and some ALPA members have gone to the Air Force's B-47 school. All this is good, but it is not enough.

As the agency responsible for administering the safety regulations and operating the nation's airways system, CAA must have the means to acquire more direct and intimate knowledge of jets before they go into civil use some three years from now. It is clearly my duty to see that CAA gets the means for such familiarization, and I intend to do so. As I visualize it, this task can be accomplished in two stages.

Plans Use Of B-47

First, we are negotiating for the use of a B-47 at our Aeronautical Center in Oklahoma City. The Aeronautical Center is the training headquarters for our personnel. Just as we gave indoctrination courses there in four-engine equipment right after World War II, when such equipment was just coming into civil use, so must we now prepare our safety agents, airways and airport people for the jets that will become standard in a very few years, In addition, we would operate this B-47 in and out of terminal areas, to shake down our ideas on jet penetrations. We can do some wonderful work on our dynamic traffic simulator at Indianapolis, but I am sure you will agree with me that there is nothing like the real thing for finding out what counts in the clinch.

In the second step we are working on a cooperative plan for the operation under CAA auspices of a civil jet transport. We plan to run the 707 or DC-8 over a route like Seattle-Denver-Chicago-Washington. The learning possibilities will be tremendous. In this stage I have in mind the benefits that would accrue not just to CAA, but to all segments of the industry. Such an operation would give ground personnel at every airport where the plane stopped some first-hand experience with whatever special handling problems may arise— and there are bound to be some, although probably not as many as was first thought.

I know CAA agents will be a lot happier about carrying out their safety responsibilities for jets with some actual experience under their belts, and I think you pilots will find this situation more satisfactory, too.

Enforcement Policies

Speaking of our safety agents, I would like to interject a few thoughts at this point about our enforcement philosophy, which I think must change to keep up with the world in which it functions. In the early days of aviation, we had relatively few airplanes and pilots, and both varied widely in quality. All sorts of ramshackle crates were in service, and at least a sizeable minority of pilots prided themselves on being daredevils. Consequently, the major effort of the government enforcement agency had to be directed toward making a reality of higher standards — standards of airworthiness for aircraft and competency for pilots.

As the number of aircraft and pilots increased, so did their general level of reliability. While we have not reached perfection, and never will, the record shows that we now may safely depend to a considerable extent on the cooperation of the industry itself for maintenance of these high standards. And when I use the word "industry," of course, I include the ALPA. That is why we intend to keep in the closest touch at all times with groups like yours.

But while delegating increasing responsibility for certification of planes and pilots, we must devote more attention to the operations of the certificate-holders. The very fact that we have such a greatly increased volume of operations creates enforcement problems in the air, just as it does on the highway.

Pilot's Responsibility

The safety of sky traffic depends a lot more on the controllers than does the safety of ground transportation on the traffic policemen, and I will come in a minute to some specific ways in which we propose to give more help. But the fact remains that the pilot is the commander of the aircraft, and with this authority must go responsibility.

It is my feeling that enforcement attention very likely will have to shift in the direction of achieving an even higher standard of care in operations, particularly through congested areas.

This is a two-way street. We expect every pilot—just as we expect every controller—to exercise the utmost care when operating in congested areas. What may be permissible at Laredo may be intolerable at LaGuardia. We are going to improve traffic handling from the ground just as fast as possible, but you will have to accept the fact that for a while longer we will not always be able to give you the kind of clearance you want as fast as you want. Recognizing that, you will have to fly accordingly, even if it means some minor delay.

Automation

Now to get over to a more positive and pleasant phase of our program: automation.

Partly as a result of publicity about "Sage," we have heard an awful lot of talk recently about the need for an automatic air traffic control system. To all such statements I can add a hearty "Amen." Certainly no one is more conscious of the difficulties of a manual system than the agency, which is trying to make it work in the face of an ever-expanding load.

But let us be quite clear in our minds, as we read the intriguing stories about "Sage," that it offers no immediate answer to a pilot's prayer. First of all, "Sage" is designed primarily to direct an individual fighter plane toward an individual enemy bomber. It will require extensive revision to accomplish the air traffic control mission of directing a considerable number of planes away from one another. Secondly, there is in existence only one "Sage" set-up, the prototype in the Boston area. It must be produced, installed and debugged at all the required military locations before the necessary steps can be taken to make it available for civil use.

Due consideration is being given to the adaptation of "Sage" for ultimate civil use, but as I said before, we have an immediate problem, and we are going to take some immediate action in the direction of automation.

Indianapolis ARTC Center

I have just signed a letter of intent to International Business Machines Corporation, for the installation at our Indianapolis Air Route Traffic Control Center of a Magnetic Drum Data Processing Machine with Printer.

This machine is an electronic digital computer that we are getting out of IBM's regular production flow. With it, we hope to accomplish two modest, but realistic and immediate objectives.

First of all, we expect to find out if it furnishes an acceptable means of mechanizing the essentially clerical duties of the controller, freeing him for his more significant responsibilities of analysis and decision-making.

The system envisions the filing of flight plans at several centralized positions, where an operator copies them on a typewriter card punch that prepares an input card for the computer. When this card is fed in, the computer searches the data stored in the magnetic drum and prepares a complete flight progress strip for each reporting fix which the aircraft will pass in flight. The information emerges printed in clear language on a strip which can be inserted in the holders now used at control positions.

By operating this device, we hope to accomplish the secondary purpose of getting our feet wet in the computer field. We look for increasing application of computers to civil aviation operations, and believe it is high time our people had a chance to work with such machines. Who knows, perhaps they will come up with some new twists that might not occur to men without their practical experience.

Information

This is the least self-explanatory of the headings in our four-point program for immediate traffic control improvements. What I am getting at by the term, however, is something that I believe is very close to your hearts. You feel the need for a more positive form of traffic control, and the key to more positiveness is more information. We can provide separation under all conditions only if we have complete and instant knowledge of traffic, and the means of instant communication with that traffic.

Where can we get the kind of knowledge we need? Obviously, the basic source must be radar. There are two ways of increasing our radar capability, and we are using both. One is to take all possible advantage of existing military facilities. Within the last few weeks, we launched an intensive program for testing a tie-in of Air Defense Command radar to our Indianapolis air route traffic control center. This will be supplemented by joint activity in the Boston area.

In addition, it will be necessary to install more CAA radar. That is the essence of our 5-Year Plan. Details of this plan are of course reserved until the Congressional appropriations committees have completed their study of it, but to give you an idea of its scope I can point to the President's budget message. Some of you may have overlooked these figures that were sandwiched into the 1180-page volume occasionally referred to as "the telephone book." It is worth noting, however, that the message proposes that 69 long-range radars be installed by 1961, of which 18 should be provided for next fiscal year.

Envisions Future

As we get these radars, and an accompanying expansion in communications capacity, we can provide complete control of the airspace starting in the higher altitudes. This is something the military needs immediately, and that you will need in the near future for jet operations.

Meanwhile, for our growing volume of general aviation, the 5-Year Plan calls for 383 additional omniranges. With the saturation coverage that these would provide, general aviation should be able to operate safely and without burdensome restrictions.

I can visualize a happy compromise (if any compromise ever is happy) between the two schools of thought on positive control. Perhaps only a few highly congested routes and zones might have to be placed on a full Instrument Flight Rules (IFR) control

basis. Elsewhere, the IFR requirement would be confined to the high altitudes.

It should be realistically recognized that this nation can buy whatever degree of traffic control it is willing to pay for. The CAA is an executive agency that is willing and anxious to do the job, but the boundaries of the job must be defined by the people through their elected representatives in the legislative branch.

I believe that American public opinion is awakening to the urgency of the problem; that there is a growing demand for an action program to maintain order on the skyways; and that we are going to get the tools we need to meet this great challenge.

Labor And Management

Gains Made By Employees Are Necessary To Long-Run Success Of Industry

By William F. Schnitzler

AFL-CIO Secretary-Treasurer

(Reprinted from The AFL-CIO American Federationist*)*

The labor of a human being is not a commodity or article of commerce. Trade unions do not exist to buy cheap and sell dear the persons and energies of their members. A trade union *speaks* for its members; it does not own them. Trade unions *are* workingmen, and workingmen are brothers. It is altogether unnatural that they should be divided.

Some spokesmen for industry have responded to labor unity with cries of "monopoly" and demands for still another round of repressive legislation. To the extent that these expressions may be sincere, they are founded upon a fallacy.

In the business world, the term "merger" implies to some an extension of control on the part of an element in management seeking to secure or maintain a position of competitive advantage in the marketplace. To them, its logical ultimate development is total monopoly. Short of that goal, its object is size—sometimes for its own sake and sometimes for the sake of economic power. It must be remembered that the attitudes, concepts and motives that govern the business world cannot be so easily transposed and applied as a gauge to the course of trade union affairs.

Labor's Merger

Merger has united 15,000,000 workers into a single labor federation. This is an impressive total, measured against the past, but there is no magic in numbers alone, that brings automatic guarantees of relative gain to labor or loss to management, or any threat of "labor monopoly" into the collective bargaining picture.

To the employer who negotiates with a local union representing the employes in his plant, it matters little whether the trade union movement at large numbers five million, ten million, fifteen million or thirty million, in terms of his own immediate economic interests. He will continue to see the same faces across the bargaining table, and the process of give and take, demand and compromise, will continue as before.

Why do conservative and presumably hard-headed employer groups profess anxiety? I suspect that the reasons have little or nothing to do with economics or the realities of collective bargaining. I believe that their fears are mostly subjective and are based upon their own class complexes and feelings of insecurity about the future of their status as a class. They have, in short, made the very serious mistake of believing their own propaganda about the "revolutionary" or "socialistic" character of the trade union movement.

No 'Class Struggle' Theory

If there ever was a time when the bonafide trade unions of America actually believed or practiced the theory of "class struggle," that day has long since passed. The established labor movement of today is far more immune to revolutionary slogans and doctrines than were the struggling trade unions of the Nineteenth Century. The success of American labor in achieving practical economic benefits and gains for its members has committed it completely to the preservation of the American economic, social and political system. Where the rhetoric of the trade unions of the distant past fairly bristled with the language and slogans of class conflict, that of the modern trade union movement repeatedly expresses the devotion of labor to the American way of life.

So long as it continues to afford workingmen an adequate opportunity for individual and collective progress, labor has no quarrel with capitalism, the profit motive, the free enterprise system or whatever one may choose to call the American economic structure. Nor does labor have any desire to achieve a position of dominance over other economic groups, or to challenge the legitimate status and prerogatives of management. Can management boast of an equal degree of forbearance in its attitude toward labor? I think not.

Not Anti-Business

No one can deny, that there have been many attempts by employers—some of them successful—to break their employes' unions. I know of no case in which a democratic American trade union has ever deliberately undertaken to put any employer of its members out of business.

The author (left) on recent visit to Home Office.

There is no trade union end that would be served thereby, for the injury of employers or owners as a class is not included in the catalogue of labor's objectives — even though the destruction of trade unions as such, appears to be a primary aim of some employers. We want the employers with whom we deal, to be successful and to make plenty of money. We do not begrudge ownership its profits, for we realize that the success of industrial enterprise is necessary to our own success in achieving substantial economic gains for our members.

I would suggest that it is high time, more people in the ranks of management began to recognize that the converse is also true — that the gains achieved by trade unions for their members are also necessary to the long-run success of industrial enterprise in America.

Legislation To Aid Labor

Labor's interest in political affairs never has had as an object the injury or repression of management or the denial of the legitimate rights of management. Our legislative efforts are directed, not against management or any other group, but in behalf of the rights and interests of workers, for the protection of their right to organize and to operate as unions, to bargain collectively, to receive a decent minimum wage for a fair day's work and to enjoy some protection against the hazards of life through the instrument of social insurance.

We have never sought legislation to suppress or restrain the activities of the N.A.M., the Chamber of Commerce or any association of employers. Yet a very great portion of the lobbying and political activities of those organizations is devoted to the promotion of laws designed to destroy the trade union movement as an effective instrument of the working men and women of America. It is high time that management began to practice more widely, in this area, the philosophy of free enterprise that it preaches, to follow the policy of "live and let live," and to concede to workers the same opportunity to enjoy rights and liberties that management demands for itself.

Insofar as the relations between labor and employers have contained any element of "class conflict," it has stemmed, not from any revolutionary impulse on the part of organized labor, but from the class-conscious hostility of management.

Labor has been the victim rather than the aggressor in this respect.

Flier's Forum

We Need 100% IFR Now

I'm just one of the common ordinary garden variety pilots, who goes about his daily rounds with consideration for his passengers and fellow pilots, and only beats his wife and children when the doctor decrees exercise. Because I'd like to continue this well-oiled routine, I'd like to take issue with Bob Stone's excellent article in the February AIR LINE PILOT.

It seems to me that any means of controlling traffic by calling it VFR or IFR, based on *visibility*, is wholly unrealistic. In all honesty, I don't believe any pilot can judge horizontal visibility with the accuracy needed to differentiate between three miles or five miles. I doubt whether the human eye is capable of making this measurement—particularly when both objects are moving at relative speeds up to 500 knots. Doing this at night would make it doubly difficult. Anyone able to judge distance this accurately from an airplane, has no business flying—he should be walking on water.

Let us not kid ourselves, gentlemen—we can ill afford self-deception in this business. Our only hope for a safe future, and collecting both our A & B funds, is 100% IFR regardless of the weather. There can be *no* compromise with our lives and those of our passengers—and any visibility requirement for clearance purpose is a compromise. The dread specter of a mid-air collision over a metropolitan area is not only a possibility—it's an absolute certainty under our present rules. The only question is where and when.

Let me also prey on your good nature and inherent laziness with a few well chosen remarks on Rube Snodgrass' article on "All-Weather Instrumentation." Fortunately our DC-7's have the Sperry Auto Coupler, and I've had the dubious pleasure of using it down to minimums a number of times. The coupler is an excellent aid to low approaches (200') when it is working right—but it doesn't always work right—and therein lies its weakness.

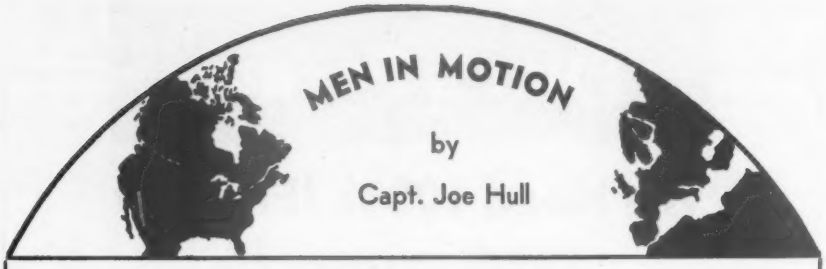
With rare exceptions, the aileron and rudder controls overcontrol badly, and the airplane goes rocking along the ILS like a couple of cool cats at Roseland—certainly a performance unacceptable for a hand flown ILS.

By the time the pilot decides to abandon the Auto approach and recover by hand, he's in a very poor position for a recovery and a down-the-slot approach. It's this reliance on an electronic device that can put a man out on a limb, that constitutes its real weakness.

Personally I'd be very reluctant to use a coupler to 100' unless their performance is much better than the present model—and more uniformly reliable. In the final analysis, there is NO substitute for visual guidance that last delicate distance, and our own ALPA lighting system is our only answer. There are precious few missed approaches at Newark or Idlewild or San Francisco—and much tranquility of spirit. We love those protons and neutrons, but, Oh Lord, give us this day those electric lights.

LEO KRILOFF
Captain,
United Air Lines
San Francisco

(EDITOR'S NOTE: *In order to keep* FLIER'S FORUM *a medium for the free exchange of opinion, contributors to this department are given the widest latitude within good taste. The opinions expressed are those of the authors and not necessarily those of* THE AIR LINE PILOT *or the Air Line Pilots Association.*)



The Crime Of The Century

The dastardly bombing of a United Airlines DC-6 over Colorado has brought home to air line pilots just how vulnerable a ship in flight can be to the diabolical cunning of a John Gilbert Graham. Just as Judas betrayed his master for 30 pieces of silver, so did Graham allegedly murder his mother and 43 other unsuspecting people for filthy lucre, love for which the Bible tells us is the root of all evil.

This was a crime almost beyond belief. Even calloused law enforcement agents and hardened detectives of the FBI were shaken by this heinous and wanton killing, the greatest mass murder in American history. The devilish scheme took 44 lives and cost the insurance underwriters a cool two million dollars, paying for the airplane and the dozens of life insurance policies on the passengers.

But costly as it was, the real impact comes from the sobering realization that here we have a new enemy of air safety with which to reckon, an insidious risk which we had not calculated, one for which there is little or no defense. The bill currently pending in Congress to make sabotage of an airliner a capital offense while a belated move in the right direction, and a possible deterrent to rational people, is hardly likely to deter a future fiend from perpetrating mass murder, once his warped senses of morality tempt him into consideration of it. For, after all, what devil who is conjuring up such a cruel and satanical scheme is likely to worry about the amount of penalty he will pay if he is caught? It must be taken for granted that he expects to swing if his plot is discovered.

Sabotage is not really new to the aviation industry although we have been spared its demoralizing savagery here in America. Revolutionaries in Latin America have bombed planes to dispose of political enemies; it has happened too in Europe and Asia. And once, in Quebec, a Trans-Canada DC-3 was bombed by an assassin who devised an ingenious time clock bomb to wipe out an unwanted member of his family. In this case Canadian justice was swift and sure: the gallows claimed the murderer. An attempted arson of an airliner in California some years ago failed, not because it was discovered, but because the plotter lost his nerve at the last moment and called back the ship after it had taxied away for take-off.

No matter what happens to Graham, even if he expiates his terrible sin in Colorado's gas chamber at Canon City, it will bring little solace to the bereaved survivors of the hapless victims of his blood-curdling deed. Of all the broken families, probably not many of them will derive much satisfaction from knowing that the mills of the gods grind slowly but surely. Their primary unhappiness stems from the shocking revelation that there still is no satisfactory safeguard before flight departure time to detect such a plot. It will take a mighty reassuring sales job to ever get one of these people aboard an airliner again.

Even though Graham's fiendish crime did point out to the world a seemingly easy way to do away with somebody whose money is more important to the assassin than the victim's life, the marvelous job the CAB and the FBI did in unravelling this Hitchcock thriller should put all such fools on their guard. To anybody who has ever watched

(Continued On Adjoining Column)

(Continued From Adjoining Column)

the eagle-eyed CAB investigators going through a pile of charred rubble with a fine tooth comb for clues it came as no surprise when they discovered almost immediately that a bomb had been placed aboard the ill-fated DC-6. The FBI did the rest. Graham's plot failed for one reason: he was unable to dispose of the evidence.

This brings us to the crux of this story. *Supposing he had kissed his mother goodbye and put her aboard a DC-6 for Europe?* Only 15 minutes out of Idlewild—or Boston, or Miami, or anywhere that overseas flights originate on the coast—is all that would have been required for the success of the plot. The deep, inscrutable waters of the sea would have swallowed the wreckage and hid the wicked secret forever. Even though the FBI, through background work, might have disclosed that suspicions of sabotage existed, the absence of a corpus delicti or any remnants of the crash would preclude prosecution of the suspected murderer.

That these dead shall not have died in vain, we need something much more potent than a simple law to prosecute a saboteur. I cannot find it in my reason to believe that Graham's crime will touch off a rash of kindred attempts on domestic flights; the risk of discovery is too great. *But I do believe implicitly that a very distinct threat to overseas flights does exist.* No luggage is ever examined at the point of origin by customs officials; this is always done

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In addition to the pending sabotage bill, we should bend every effort to see that a careful inspection system is established for every overseas flight, covering both luggage and freight. Pan-American and American Overseas Airlines did this for many years and even though the vastly increased air traffic of today would mean a great deal of additional work, I believe it is imperative that we return *immediately* to this inspection system. It takes about two hours to get an overseas flight checked in and serviced; while this is going on two bonded inspectors of the airline could check over every bag and box that goes aboard. Passengers will not object to this because they will know it is in their interest and for their safety.

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Evacuation
J. F. Avellar and J. E. McKenna of Aircruisers Company demonstrating evacuation device.